REMARKS

In response to the Office Action mailed February 11, 2004, Applicant has amended the application as above. No new matter is added by the amendments as discussed below. Applicant respectfully requests the entry of the amendments and reconsideration of the application in view of the amendments and the remarks set forth below.

Discussion of Claim Amendments

Claims 1-13 have been amended. Claims 14-17 have been added. Upon the entry of the amendments, Claims 1-17 are pending in this application. The amendments to Claims 1-13 are merely for clarification or to conform the claims to U.S. practice, and thus do not narrow the scope of protection. New Claim 14 is supported by, for example, the specification at page 38, lines 16-21. New Claims 15-16 are supported by, for example, the specification at page 17, lines 8-16. New Claim 17 is supported by, for example, original Claim 11. Thus, no new matter is added by the amendments. Applicant respectfully requests the entry of the amendments.

Discussion of Drawing Objection

The Examiner objected to the drawings because of poor character of lines, numbers and letters. In reply, Applicant submits herewith a set of formal drawings that overcome the objection. Withdrawal of the objection is respectfully requested.

Discussion of Specification Objections

The Examiner objected to the specification because it contains an embedded hyperlink and/or other browser-executable code. In reply, Applicant has deleted the portions as reflected in the "Amendments to the Specification" section.

The Examiner also requested that the application serial number of the provisional application filed June 1, 2000, omitted in the Related Applications section, need to be inserted. In reply, Applicant has inserted the application number. Withdrawal of the objections is respectfully requested.

Discussion of Information Disclosure Statement

The Examiner asserts that the listing of the above-indicated hyperlink references in the specification is not a proper information disclosure statement and must be submitted in a separate paper. However, Applicant already listed the above-indicated references in PTO-1449 form and submitted copies of all available (three) references on November 9, 2000. Applicant submits herewith a courtesy copy of the previously filed IDS. Applicant respectfully requests that the Examiner consider the IDS references in this application.

Discussion of Claim Objections

The Examiner has objected to Claims 1-13 under 37 CFR 1.75(c) as being of improper dependent form and failing to further limit the subject matter of a pervious claim. The Examiner notes that Claim 1 does not clearly define the claim as being either only a method or only an apparatus claim and is therefore indefinite. In reply, Applicant has restructured the claim to clearly recite a method of simulating signals. Applicant respectfully submits that Claim 1 is now definite.

The Examiner also notes that Claim 2 does not further limit Claim 1 since it refers to the method recited in Claim 1, but recites "wherein said the system being an essentially electrical system." Applicant respectfully submits that Claim 2 is directed to a method claim and thus definite. Claim 1 recites a method for simulating signals in a simulated system. Claim 2 further recites that the system is an essentially electrical system. Since a dependent claim includes all of the limitations of its independent claim, Claim 2 can read "a method for simulating signals in an essentially electrical system. Applicant respectfully submits that the language "simulating signals in an essentially electrical system" recited in Claim 2 is, as a whole, an acceptable method limitation. In view of the above, Claim 2 is in proper dependent form and definite.

The Examiner further notes that all of the dependent claims merely refer to a number, and not specifically to the independent claim, i.e., the method of "1," for example, instead of "Claim 1." In reply, Applicant amended all dependent claims accordingly. In view of the above, withdrawal of objections is respectfully requested.

Discussion of Claim Rejections Under 35 U.S.C. § 101

The Examiner has rejected Claims 1-13 under 35 U.S.C. § 101 because the claimed invention is directed to non-statutory subject matter. The Examiner states that Claim 1 mixes statutory classes. As discussed above, Claim 1 has been amended to be directed to a method claim. Thus, Claim 1 and all other claims are directed to statutory subject matter. Withdrawal of rejections is respectfully requested.

Discussion of Claim Rejections Under 35 U.S.C. § 112, ¶ 2

The Examiner has rejected Claim 1 under 35 U.S.C. § 112, second paragraph as being indefinite. The Examiner asserts that the claimed invention is directed to non-statutory subject matter because Claim 1 mixes statutory classes. As discussed above, amended Claim 1 and all other claims are now clear and definite. Withdrawal of the rejections is respectfully requested.

Discussion of Claim Rejections Under 35 U.S.C. § 103(a)

The Examiner has rejected Claims 1-13 under 35 U.S.C. § 103 (a) as being unpatentable over "MATLAB Version 5.2" in view of K. Schneider (Efficient Simulation of Multi-Carrier Digital Communications Systems in Nonlinear Environments) or M. Yan (Novel Adaptive Linearization Scheme for Multi-Carrier Power Amplifiers using Samples of Multi Channels). Applicant respectfully traverses the Examiner's rejections as discussed below.

Standard of *Prima facie* Obviousness

In order to provide a *prima facie* showing of obviousness under 35 U.S.C. § 103(a), all the claim limitations must be taught or suggested by the prior art. *See, e.g., In re Royka,* 490 F. 2d 981, 180 U.S.P.Q. 580 (CCPA 1974); MPEP 2143.03.

Patentability of Independent Claim 1

Claim 1 recites, among other things, representing at least one of said signals by a sum of at least two carriers, each carrier being modulated by a bandpass signal, wherein at least two of said bandpass signals have a different bandwidth. However, the above-recited claim term is not taught or suggested by the prior art references, alone or in combination.

1. **MATLAB Neither Teaches nor Suggests "Representing at least One of said Signals by a Sum of at least Two Carriers, ..., a Different Bandwidth"**

MATLAB is directed to integrating computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation. *See page 1-3, first paragraph.* The MATLAB reference further discloses that:

> Simulink, a companion program in MATLAB, is an interactive system for simulating nonlinear dynamic systems. It is a graphical mouse-driven program that allows you to model a system by drawing a block diagram on the screen and manipulating it dynamically. It can work with linear, nonlinear, continuous-time, discrete-time, multivariable, and multirate systems. *MATLAB, page 1-8, second paragraph.*

That is, MATLAB is directed to technical computing language which can be used for computation, modeling and simulating, etc. However, nowhere in MATLAB is there a disclosure or teaching of "representing at least one of said signals by a sum of at least two carriers, each carrier being modulated by a bandpass signal, wherein at least two of said bandpass signals have a different bandwidth" recited in Claim 1. The Examiner also acknowledged that MATLAB does not teach signals representing carriers modulated by a bandpass signal. *See the Office Action, page 8, fourth paragraph.* In view of the above, Applicant respectfully submits that MATLAB neither teaches nor suggests the above-indicated claim term.

2. **Schneider Neither Teaches nor Suggests "Each Carrier being Modulated by a Bandpass Signal, wherein at least Two of said Bandpass signals have a Different Bandwidth"**

Schneider discloses a partial sum of products (ParSOP) to reduce the sampling rate for simulation of frequency division multiplexing digital communication systems. *See Abstract.* The Schneider reference arguably discloses that an input signal (x(t)) is expressed by a sum of three carrier signals (*see Equation 15, page 341*) but neither

discloses nor teaches "each carrier signal being modulated by a bandpass signal, wherein at least two of said bandpass signals have a different bandwidth" recited in Claim 1. Schneider states that:

> The partial portion of the sum includes only those products that have significant energy within the bandwidth of the single subcarrier of interest. If the channel spacing is sufficiently wide, the partial sum will include only those products that are centered in the channel of interest. The resulting reduction in the simulation bandwidth is shown in Figure 1 (*see also "ParSOP Method bandwidth" in Figure 1*). With the ParSOP method, the simulation sampling rate need only be large enough to accurately model the intermodulation products falling within the channel of interest rather than having to be large enough to simulate the entire bandwidth of the composite signal. As a result, a ParSOP simulation can show a significant reduction in the simulation runtime when compared to a conventional simulation. *Schneider, page 339, column 1, last paragraph.*

Applicant respectfully submits that in order to perform its intended purpose, the Schneider system is required to use a single simulation sampling rate. In contrast, in the claimed invention, each carrier signal is modulated by a bandpass signal, wherein at least two of said bandpass signals have *a different bandwidth.* One embodiment of the claimed invention discusses that since bandwidths of each of the modulated signals can differ from modulated signal to modulated signal within one signal, the system enables the use of different sampling rates for each of the bandpass signals. *See the specification, page 11, lines 4-9.*

If the Schneider system is modified to use multiple sampling rates, it is clear from the above-indicated description and Figure 1 that the Schneider system would be inoperable for its intended purpose. MPEP 2143.01. In view of the above, Applicant respectfully submits that Schneider neither teaches nor suggests the above-indicated claim term.

3. Yan Neither Teaches nor Suggests "Each Carrier being Modulated by a Bandpass Signal, wherein at least Two of said Bandpass signals have a Different Bandwidth"

Yan discloses a multicarrier power amplifier where the coefficients of a predistorter are obtained by canceling the third and fifth order intermodulation distortion products of

samples of multiple channels. *See Abstract.* The Yan reference arguably discloses that an input signal (s(t)) is expressed by a sum of three carriers (*see Equation 5*) but neither discloses nor teaches "each carrier being modulated by a bandpass signal, wherein at least two of said bandpass signals have a different bandwidth" recited in Claim 1. Yan states that:

> A look-up-table (LUT) has been used to contain the values of the complex gain of the multi-carrier power amplifier. It is a function of input signal power. The complex gain vector $G_1 + jG_2$ is extracted by the input power and multiplied by input signal complex vector generating the complex envelope of power amplifier's output. *Yan, third page, column 2, the second last paragraph.*

Determining from Figure 4 and the above-cited description, the Yan system generates the power amplifier's output by combing three carriers(e^{jw1t}, e^{jw2t},e^{jw3t}). However, nowhere in Yan is there a disclosure or teaching of "each carrier being modulated by a bandpass signal" recited in Claim 1. Furthermore, since Yan does not disclose "each carrier being modulated by a bandpass signal," the Yan reference cannot disclose "wherein at least two of said bandpass signals have a different bandwidth" recited in Claim 1.

Yan further states that:

> Our method provides a flexible way to linearize MCPA (Multi-carrier Power Amplifier) even if the multiple-frequency channels have unequal channel bandwidth. *Yan, third page, column 2, first paragraph.*

This can mean that each input channel frequency has an unequal channel bandwidth. However, this disclosure neither teaches nor suggests "each carrier being modulated by a bandpass signal, wherein at least two of said bandpass signals have a different bandwidth" recited in Claim 1. In view of the above, Applicant respectfully submits that Yan neither teaches nor suggests the above-indicated claim term.

4. Summary

As discussed above, none of MATLAB, Schneider and Yan teach or suggest "representing at least one of said signals by a sum of at least two carriers, each carrier being modulated by a bandpass signal, wherein at least two of said bandpass signals have a different bandwidth" recited in Claim 1. Furthermore, even if the references are combined, the combined teaching would not suggest the above-indicated claim term. Therefore, Claim 1 is allowable over the prior art of record. Applicant respectfully requests withdrawal of the rejection.

Patentability of Independent Claim 11

Claim 11 recites, among other things, i) means for transforming said representation into a computational graph, said computation graph comprising at least one of computation nodes, each computation node having a computation rule, ii) a scheduler for scheduling the execution of said computation rules of said computation nodes in time, said scheduler being adapted for scheduling the execution of said computation rule for each computation node such that for a maximum amount of computation nodes at least a sequence of computations can be performed without interruptions, and iii) means for execution said computation rules in the order determined by said scheduler. Claim 11 has been rejected over MATLAB in view of either Schneider or Yan. However, none of the prior art references teach or suggest the above-recited features as discussed below.

As discussed above, MATLAB is directed to technical computing language which can be used for computation, modeling and simulating for linear, nonlinear, continuous-time, discrete-time, multivariable, and multirate systems. *MATLAB, page 1-8, second paragraph.* However, nowhere in MATLAB is there a disclosure or teaching of means for transforming said representation into a computational graph, said computation graph comprising at least one of computation nodes, each computation node having a computation rule recited in Claim 11. Furthermore, MATLAB does not disclose or teach a scheduler for scheduling the execution of said computation rules of said computation nodes in time, said scheduler being adapted for scheduling the execution of said computation rule for each computation node such that for a maximum amount of computation nodes at least a sequence of computations can be performed

without interruptions and means for execution said computation rules in the order determined by said scheduler.

The Examiner asserts that MATLAB discloses the above-recited claim terms in the Introduction, Chapters 1, 2, pages 1-3, 1-8 and 1-9 of the reference. *See the Office Action, page 8, third paragraph.* However, Applicant respectfully submits that there is no disclosure or teaching about the above-recited claim terms in those cited portions. As discussed above, MATLAB, in the portions cited by the Examiner, merely discloses modeling and simulating, etc., for multirate systems and says nothing about the recited transforming means, the scheduler and the execution means of Claim 11. Thus, Applicant respectfully submits that Claim 11 is neither taught or suggested by MATLAB.

In addition, neither Schneider nor Yan teaches or suggests the above-indicated claim terms. As discussed above, Schneider discloses a partial sum of products (ParSOP) to reduce the sampling rate for simulation of frequency division multiplexing digital communication systems. Yan discloses a multicarrier power amplifier using sampling of multiple channels. Nowhere in Schneider and Yan is there a disclosure or teaching of the above-indicated claim terms recited in Claim 11. Furthermore, the Examiner has not provided any basis for rejection of Claim 11 over either Schneider or Yan.

In view of the above, Applicant respectfully submits that the prior art references neither teach nor suggest the above-indicated terms of Claim 11, alone or in combination, thus do not establish *prima facie* of obviousness. Therefore, Claim 11 is allowable over the prior art of record. Applicant respectfully requests withdrawal of the rejections.

Patentability of Dependent Claims

Claims 2-10 and 12-13 depend from base Claim 1 or 11, and further define additional technical features of the present invention. In view of the patentability of their base claims, and in further view of their additional technical features, dependent Claims 2-10 and 12-13 are patentable over the prior art of record.

Discussion of Claim Rejections Under 35 U.S.C. § 102(e)

The Examiner has rejected Claims 1-10 under 35 U.S.C. § 102(e) as being anticipated by Chen (U.S. Patent No. 6,181,754) or Yang, et al (U.S. Patent No. 6,263,027). Applicant respectfully traverses the Examiner's claim rejections as discussed below.

Standard of Anticipation

"For a prior art reference to anticipate a claim under 35 U.S.C. § 102, every element of the claimed invention must be identically shown in a single reference." *Diversitech Corp. v. Century Steps, Inc.*, 850 F.ed 675, 677, 7 USPQ 2d 1315, 1317 (Fed. Cir. 1988).

Discussion of Patentability of Independent Claim 1

Claim 1 recites, among other things, representing at least one of said signals by a sum of at least two carriers, each carrier being modulated by a bandpass signal, wherein at least two of said bandpass signals have a different bandwidth. However, the above-recited claim term is not disclosed by either Chen or Yang.

1. Discussion of Patentability over Chen

Chen is directed to a system and method for a behavioral model for mixed signal RF circuits in order to effectively capture linear distortion of input signals. *See column 2, lines 25-26.* Referring to Figure 4 and its corresponding description, Chen discloses that input signals (i, q), having an in-phase component (i) and a quadrature component (q) represented in rectangular coordinates, are rotated in a rotation block (405) and linearly filtered in a linear MIMO filter (406) to provide a filtered rotated signal. The input signals (i, q) are also converted to polar coordinate signals having a radial component (r) and an angular component (θ) in a transforming unit (401) and are filtered using two filters (407, 408) to provide first and second radial correction components (x,y). The filtered rotated signal is multiplied by a radial correction factor (x/y) in a block (404) to model an output signal.

That is, the input signals (i, q) are merely rotated and filtered, or coordinate-transformed and filtered. There is no disclosure, in Chen, of representing at least one of said (input) signals

by a sum of at least two carriers, each carrier being modulated by a bandpass signal, wherein at least two of said bandpass signals have a different bandwidth.

The Examiner asserts that Chen discloses the above-indicated claim term in the following section of Chen:

> Linear models simulate linear distortion over a small range of input amplitudes. A lone linear model does not exhibit gain compression. Static models scale and rotate the complex base-band input signal to generate base-band output. The complex plane is a convenient space for representing base-band signals because one carrier has two phases and each phase can be modulated independently. If the degree of scaling and rotation depends on the magnitude of the input base-band signal, the static model is non-linear. Static non-linear models capture uniform gain compression and static am-pm conversion but not linear distortion. *Chen, column 3, line 62-column 4, line 5.*

This description does not teach a specific representation relationship between input (base-band) signals and carriers. In contrast, Claim 1 recites "representing at least one of said (input) signals by a sum of at least two carriers." In addition, Chen merely discloses that the two phases of one carrier can be modulated independently. As long as the two phases of one carrier are modulated independently in Chen, the two phases are not necessarily modulated by a signal having a different bandwidth. In contrast, in Claim 1, each carrier is modulated by a bandpass signal, wherein at least two of said bandpass signals have a different bandwidth. Furthermore, Chen discloses that the two phases of the carrier, rather than the carrier itself, are modulated, whereas in Claim 11, each carrier is modulated by a bandpass signal. In view of the above, Chen does not disclose the above-indicated claim term. Thus, Claim 1 is allowable over the Chen reference.

2. Discussion of Patentability over Yang

Yang is directed to a modulator, used in a transmitter, which has only one multiplier, instead of using two multipliers and one adder existing in prior art, to reduce size, power consumption and cost of the transmitter. *See column 6, lines 30-43.* Referring to Figure 4 and its corresponding description, Yang discloses that the second multiplexer (62) receives two carriers (Cos(nθ)), Sin(nθ)) from the carrier source (66) and only outputs one of the carriers at a time by

the control of the processor (68). Either of input signals (I, Q) is multiplied in a multiplier (64) by one of the carriers (for example, I×Cos(nθ) or Q×Sin(nθ)).

That is, in Yang, the input signals (I, Q) are not represented by a sum of the carriers (Cos(nθ)), Sin(nθ)), instead one of the input signals (I, Q) is multiplied one of the two carriers (Cos(nθ)), Sin(nθ)). In contrast, Claim 1 recites "representing at least one of said (input) signals by a sum of at least two carriers." Furthermore, in Yang, the carriers (Cos(nθ)), Sin(nθ)) are merely provided from the carrier source (66) to the second multiplier (62). That is, nowhere in Yang is there a disclosure or teaching of "each carrier being modulated by a bandpass signal, wherein at least two of said bandpass signals have a different bandwidth" recited in Claim 1.

The Examiner asserts that Yang discloses the above-indicated claim term in the following section of Yang:

> The FIG. 5 embodiment is provided stored values from the memory device 70, corresponding to consecutive and alternating values of the first and second carrier wave-forms, which simulates the output of the second multiplexer 62 of the FIG. 4 embodiment. *Yang, column 9, lines 57-61.*

However, in the Figure 5 embodiment of Yang, the carrier source (66) and the second multiplexer (62) of Figure 4 are merely replaced with a ROM (70). That is, as in Figure 4, one of the input signals (I, Q) is multiplied one of the two carriers (Cos(nθ)), Sin(nθ)), which are provided from the ROM (70). Thus, this portion cited by the Examiner also fails to disclose the above-indicated claim term. In view of the above, Yang does not disclose the above-indicated claim term. Thus, Claim 1 is allowable over the Yang reference.

Patentability of Dependent Claims

Claims 2-10 depend from base Claim 1, and further define additional technical features of the present invention. In view of the patentability of their base claim, and in further view of their additional technical features, dependent Claims 2-10 are patentable over the prior art of record.

Discussion of Patentability of New Claims 14-17

New Claims 14-16 depend from base Claim 11, and further define additional technical features of the present invention. In view of the patentability of their base claim, and in further view of their additional technical features, new Claims 14-16 are patentable over the cited references. New Claim 17 includes substantially the same claim terms as in Claim 11. In view of the patentability of Claim 11, new Claim 17 is patentable over the prior art of record.

CONCLUSION

In view of Applicant's amendments to the application and the foregoing remarks, it is respectfully submitted that the present application is in condition for allowance. Should the Examiner have any remaining concerns which might prevent the prompt allowance of the application, the Examiner is respectfully invited to contact the undersigned at the telephone number appearing below.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: 7/9/04

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